I-WIRE: One Example of a Regional Empowered Network Initiative

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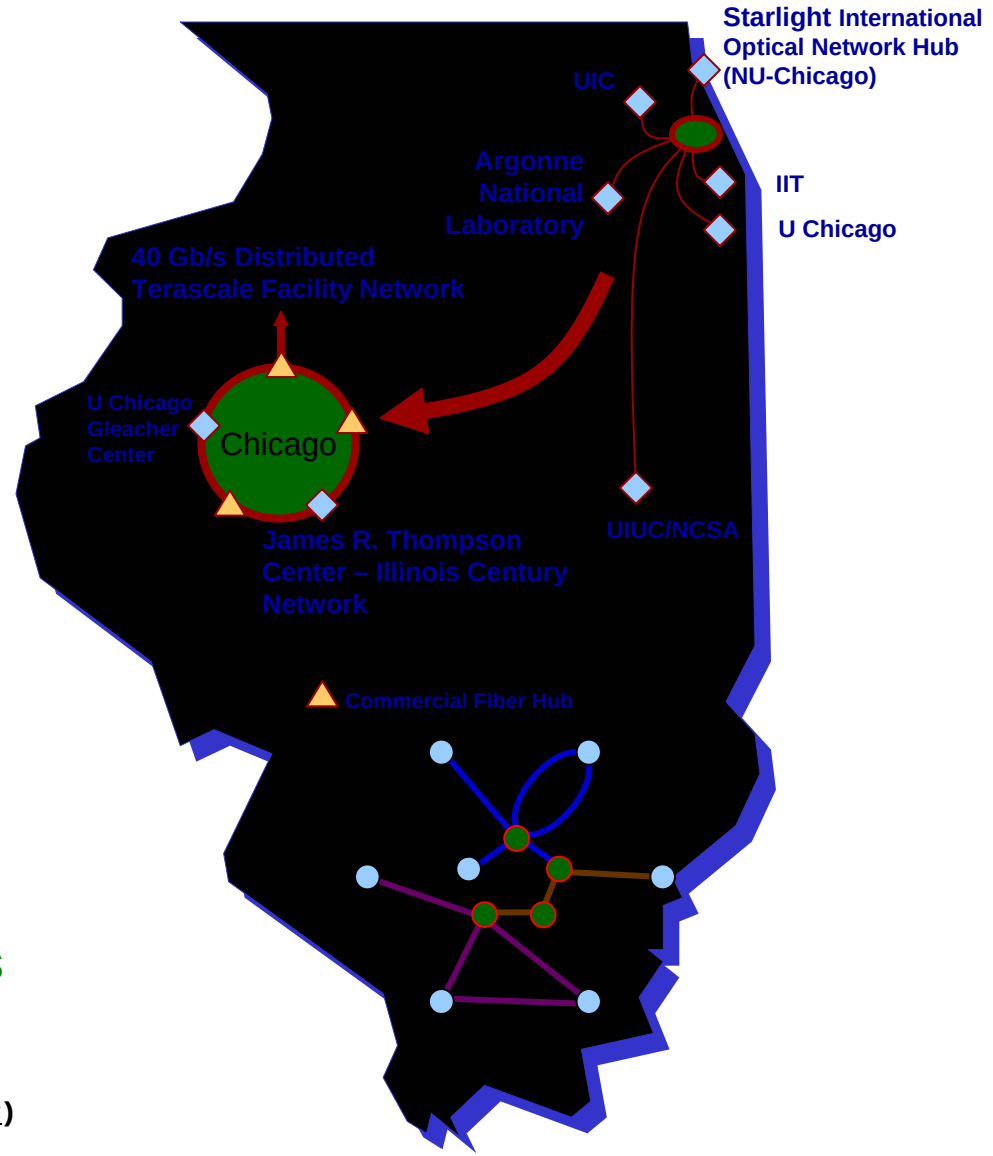
For More Information see www.i-wire.org

I-WIRE (Illinois Wired/Wireless Infrastructure for Research and Education)

- State Funded Dark Fiber & Optical Infrastructure to support Networking and Applications Research
  - $7M Total Funding (FY00-04)
  - Application Driven
    - Access Grid: Telepresence & Media
    - TeraGrid: Computational and Data Grids
  - New Technologies Proving Ground
    - Optical Network Technologies
    - Middleware and Computer Science Research
- Deliverables
  - A flexible infrastructure to support advanced applications and networking research



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Background I-WIRE Objectives

- Original Charter (circa 1998)
  - Deploy dark fiber for research projects
    - NCSA, Argonne, UC Computation Institute, UIC Electronic Visualization Laboratory
- Results
  - Dark Fiber (20 year IRU) infrastructure to 11 sites ($4M)
    - Additional sites included based on available fiber paths
    - $3M for Chicago Metro area, $1M for Urbana route
  - DWDM Transport Infrastructure ($2.5M)
    - Linear segments to ANL, NCSA; Chicago metro ring
- Architecture: “Virtual Fiber Meet-Me-Room”
  - Land at any I-WIRE site, transport to any other I-WIRE site
  - Reach as many metro landing points as feasible
    - Have already established landing points in four locations
      - 111 N. Canal, NBC Tower, Doral Plaza, Starlight

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I-WIRE Economics

- Up front cost of ~$4M for fiber
  - 20-year IRU Fiber (existing fiber)
    - $700 to $5,000/strand-mile
  - New construction (for 'last mile')
    - $30 to $100/foot ($160-530k/mile)
- Up front cost of ~$2.5M for equipment
  - Additional sites $50-75k
  - Additional channels ~$25k/OC48, ~$70k/10G
- Annual costs
  - fiber maintenance
  - equipment maintenance
  - staff effort

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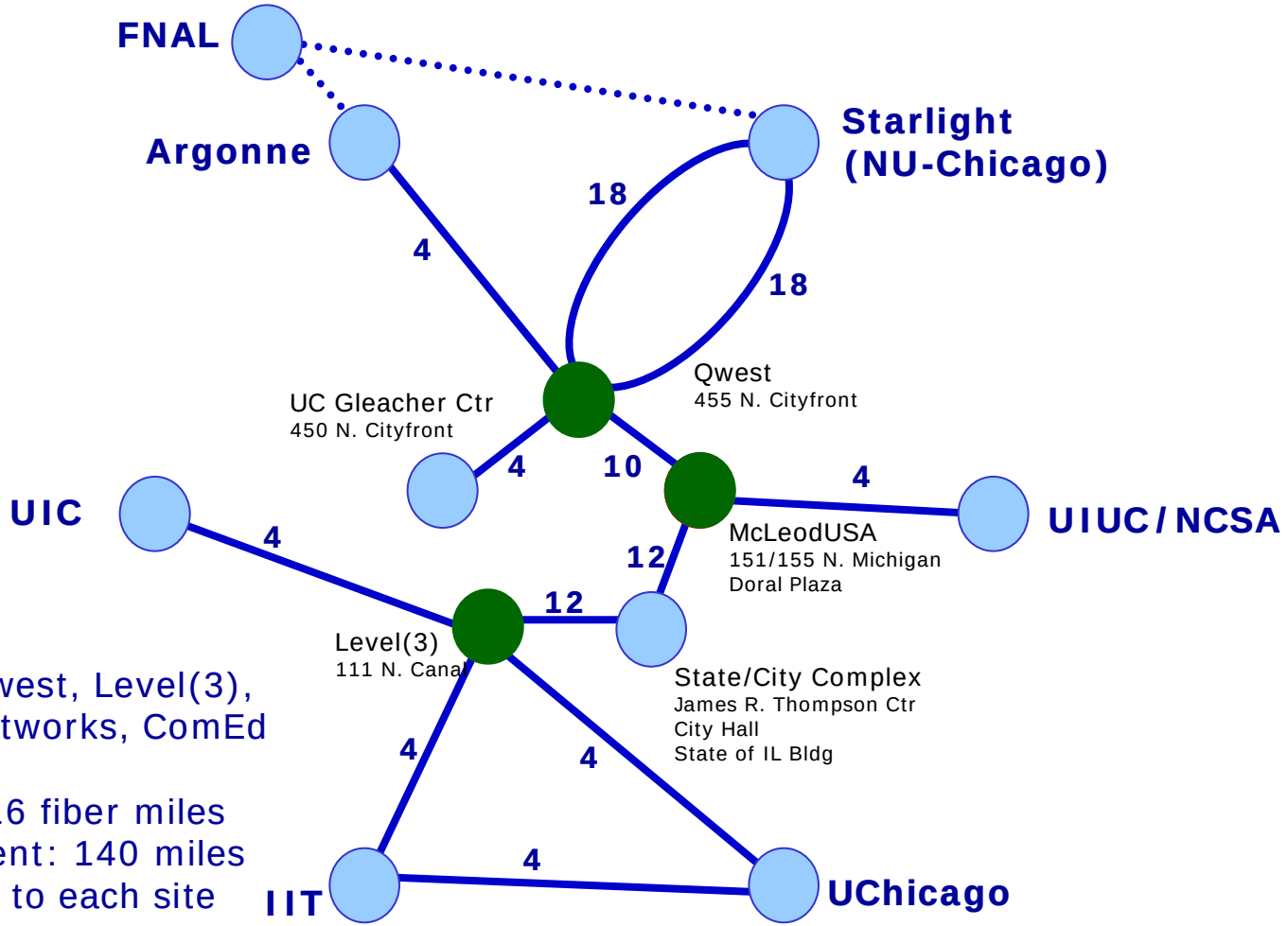
Current Status

- Ciena ONLINE Metro DWDM Systems in “Production”
  - TeraGrid Project
    - 3 x OC-192 NCSA-Starlight and ANL-Starlight
  - Optiputer Project (8GE UIC-EVL – Starlight)
  - DOT Project (planned OC-48, multiple I-WIRE sites)
- I-WIRE Support Plan
  - Next-Day maintenance
  - Redundancy for high-availability (L1 and/or L2)
- Creation of Cost-Recovery Vehicle
  - Fee Structure (base plus channel cost components)
    - Base System Maint + Engineering: Divided among participants
    - Channel Costs: Maintenance of channels used per institution
      - Recent numbers: $1.3k/yr for OC48; $5k/yr for OC-192

I-Wire Fiber Topology



- Fiber Providers: Qwest, Level(3), McLeodUSA, 360Networks, ComEd
- 10 segments
- 190 route miles; 816 fiber miles
  - Longest segment: 140 miles
- 4 strands minimum to each site

Numbers indicate fiber count (strands)

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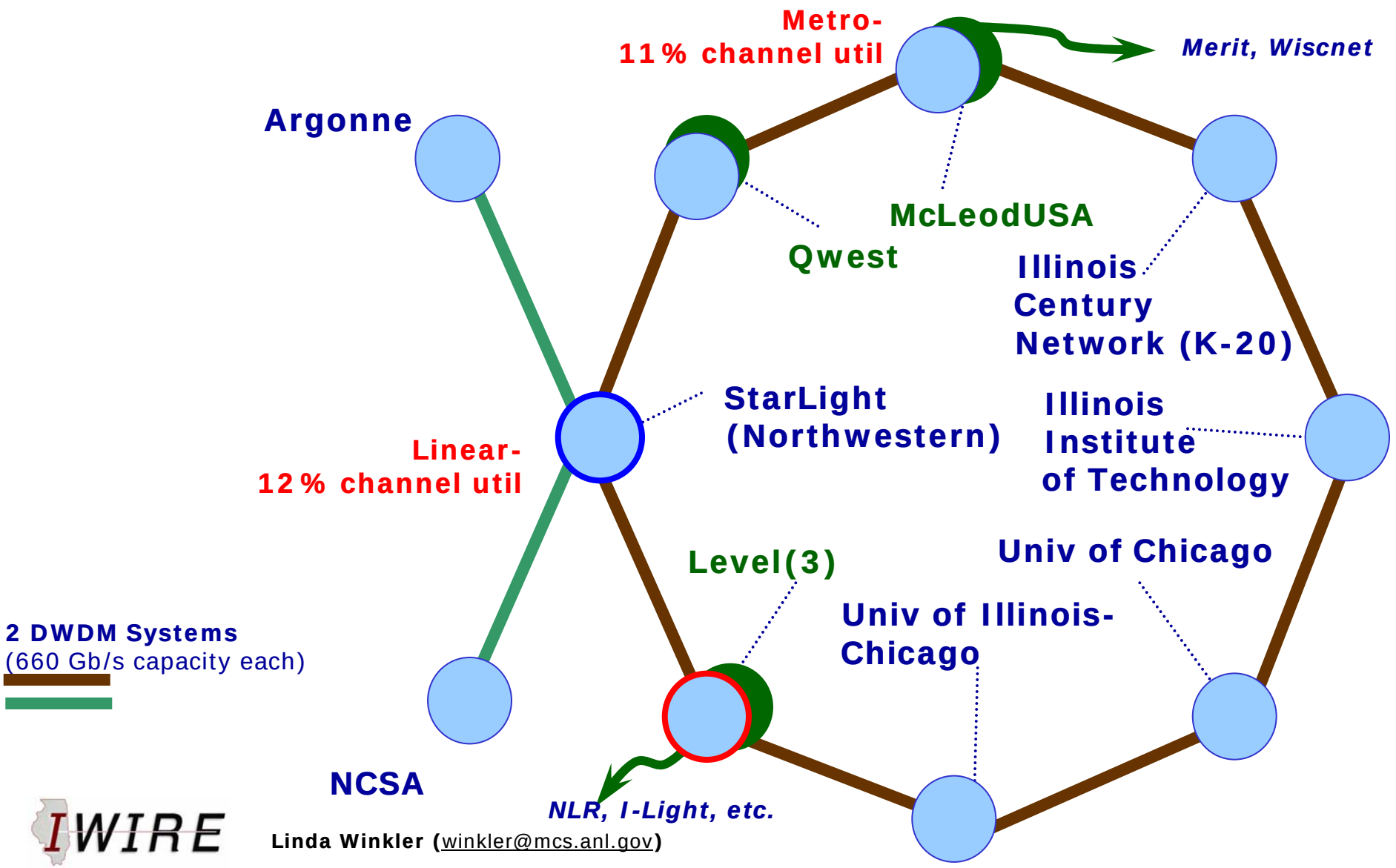
Status: I-WIRE Transport Systems



IWIRE

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IWIRE Services

- Point-to-point circuits
  - All-rate (100M-2.5G)
  - OC48 (2.5G)
  - 10GE LAN PHY (10.125G)
  - OC192 (9.952G)
- Dark Fiber Services
- 99% uptime goal
- Channel capacity
- Channel utilization

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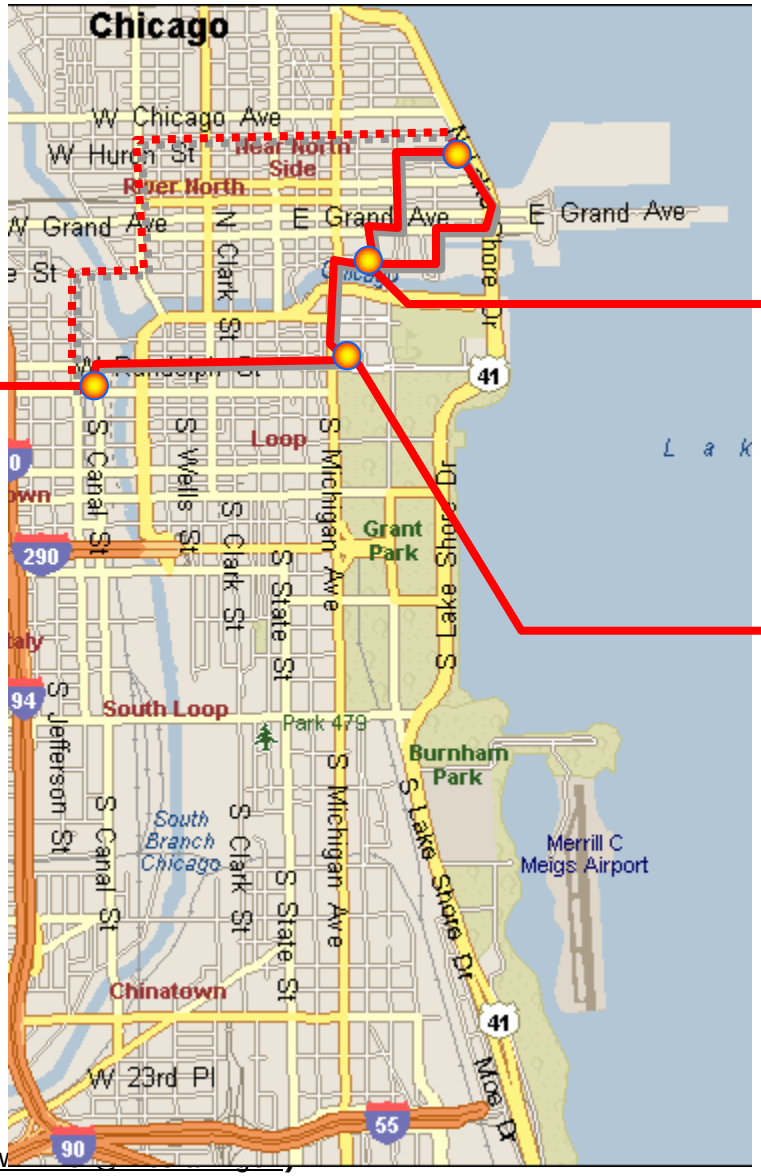
I-WIRE Virtual Fiber Meet-Me-Room

Level(3)
NLR
UI-Chicago
U Chicago
IIT



Qwest
ESnet
Abilene
Argonne

Norlight
McLeodUSA
Michigan
Wisconsin
UIUC/NCSA

IWIRE

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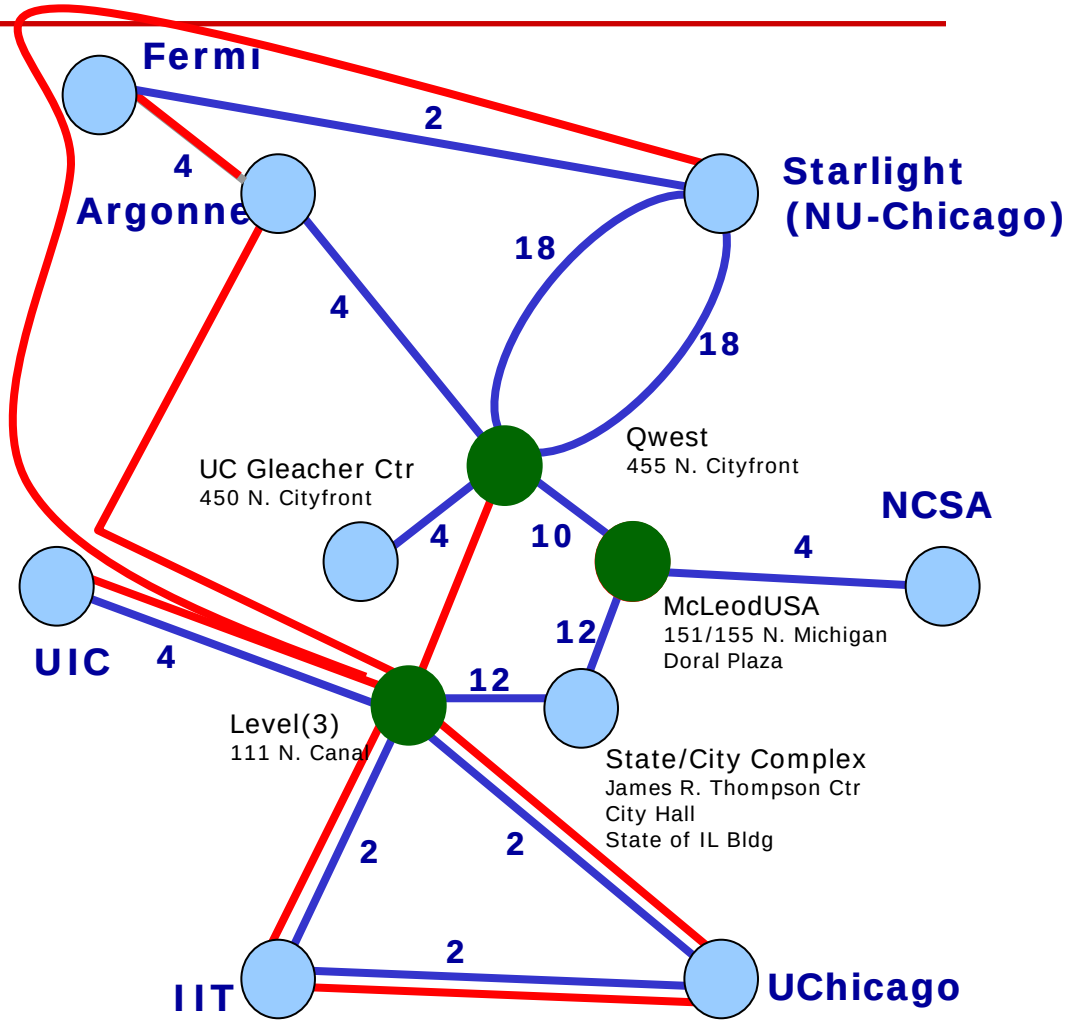
I-Wire Fiber Topology Enhancements

FY04 I-WIRE funding Targets

- Adding Redundancy Fiber Path to Metro Ring
- Augmenting fiber to metro sites to allow for multiple experiments
- Expand to new sites
- Expand to new customers (DOE)



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Numbers indicate fiber count in strands
New fiber under investigation

State of Technology

- State of DWDM Technology
  - Very mature stable, deployable, managable
- Collaborations
  - Need to work with vendors on control plane interoperabilty
  - Need to work with partners on encryption
- Technology projections
  - Dynamic provisioning
  - Topology discovery
  - Higher speed transmission remains difficult to harness on a single machine
  - Multiple stream application flows will continue dominate (Nx1GE=>Nx10GE)

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The Benefits

- Marginal cost to increase bandwidth
- Managable circuits (end points)
- Flexible architecture allows virtual organizations to create adhoc experimental infrastructures
- Deployment of high bandwidth circuits to markets underserved by traditional carriers

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